YOUNG'S MODULUS APPARATUS®
(BY PIEZOELECTRIC TECHNIQUE)

OBJECTIVE

DETERMINATION of Young's Modulus and Ultrasonic Velocity in solids like metals/quartz/glass

Non-Destructive Testing of Material is an important part of Engineering Education as it gives information without deformation in the shape and size of the material. One of the NDT techniques, Piezoelectric Technique is widely used for the measurement of composition dependent properties such as *ultrasonic velocity*, *compressibility*, *elastic constant*, *Young's modulus* and *Bulk modulus*. Its suitability for metals, plastics, polymers and crystals etc makes it versatile tool for *Engineering Physics*, *Material Science and Polymer Science*. This low cost NDT apparatus is being used in several I.I.T.s/Universities/Engineering Colleges for laboratory experiments and Research work.

In this technique the specimen is cemented to a quartz rod of identical cross section and resonant frequency (f_c) of the composite system is determined using the apparatus. The resonant frequency of the quartz rod (f_q) is also determined. From the knowledge of f_q, f_c and the masses of the quartz (m_q) and the specimen (m_s), the resonant frequency of the specimen f_s is evaluated using the relation

$$f_S = f_C + \frac{m_q}{m_c}(f_C - f_q)$$

Using the value of f_S, the length of the specimen (L) and the density of the specimen, the velocity of the ultrasonic waves in the specimen (v) and compressibility (β_{ad}) can be calculated using relations

$$v = 2 \cdot f_S \cdot L$$

$$\beta_{ad} = \frac{1}{\rho \cdot v^2}$$

where ρ is density of specimen .

Young's Modulus of specimen is calculated using relation

$$\gamma = 4 \cdot f_S \cdot L^2 \cdot \rho$$

INSTRUMENT: It consists of Piezoelectric Oscillator, power supply, quartz rod, holder, quartz rod with sample, connecting cables and R.F. meter.

Manufacturers:

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